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ABSTRACT

The first of two phases in this research project aimed at linking information technology (IT) with library information skills used the microcomputer as an information retrieval tool, and investigated ways of using curriculum-based keywords to help secondary school students define and maintain a clear sense of purpose when selecting, evaluating, and organizing information. Based in one secondary school, the project concentrated on the development of information-handling skills in curriculum-related project work. Observations, interviews, and informal discussion with students, teachers, and the school librarian formed the basis of evaluation in terms of development and use of curriculum-linked bibliographic databases. Findings indicated that the information retrieval system acted as a motivating influence in the initial stages of the students' research assignments, and that students developed information retrieval skills when databases were used over a period of time and in a number of different contexts, especially when they were fully integrated with the students' assignments. It was concluded that, to be effective as an educational tool, curriculum-linked databases should be developed from a clear statement of aims, based on the needs and abilities of the users as well as the aims and objectives of the curriculum; collaboration between librarians and teachers is essential in designing, developing, and implementing the keyword approach; and careful planning of databases should take into account the keyword language, design, and content of computer files. Eleven references are listed and samples of various materials used in the program are appended. (DJR)

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THE MICROCOMPUTER IN THE SCHOOL LIBRARY PROJECT

(MISLIP)

Phase 1 (September 1983 - August 1985)

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The school involved in Phase 1 of the project was:

Bankhead Academy, Bankhead Avenue, Bucksburn, Aberdeen, where Lynda M Bain was librarian until May 1985. (Lynda Bain is now librarian at Dyce Academy, Riverview Drive, Aberdeen.)

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Dr Joan Taylor, Vice Principal, Aberdeen College of Education (Chair)

Mrs E B Duncan, Research Fellow, Dept of Education, Aberdeen University

Ms K Henning, Project Officer, Scottish Council for Educational Technology (MISLIP Committee 1983 - April 1985)

Mr A Fyfe, Scottish Council for Educational Technology, Microelectronics in Education Committee (MISLIP Committee from April 1985)

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The KeyWord Information Retrieval System (KWIRS) software used in this project was written by Norman Paton, 21 Airyhall Gardens, Aberdeen.

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SUMMARY

The broad aims of MISLIP were

to link information technology with information skills

to identify methods of helping pupils develop skills of defining purpose, finding and using information.

Through the use of the microcomputer as an information retrieval tool the project investigated ways of using curriculum-based keywords to help pupils define and maintain a clear sense of purpose when selecting, evaluating and organising information.

The project was based in one secondary school and concentrated on the development of information-handling skills in project work related to the S1/S2 curriculum. This was viewed as an extension of the existing Library and Information Skills course which would create closer links with the curriculum.

Observations, interviews and informal discussion with pupils, teachers and the school librarian formed the basis of evaluation in terms of development and use of curriculum-linked bibliograpahic databases.

Findings indicated that the information retrieval system, regarded by pupils as more attractive and accessible than the traditional catalogue, acted as a motivating influence in the initial stages of pupils' "research" assignments. It encouraged pupils to think about a topic, structure ideas and set specific purposes as a basis for project work. It also helped them locate a wider range of references than is often the case. The librarian and teachers regarded this as a positive enhancement of project work.

Pupils developed information retrieval skills when databases were used over a period of time and in a number of different contexts. Greater benefit was derived when databases were fully integrated with the approach to complete assignments. Classroom planning of work, defining purpose in terms of questions and keywords, formed a useful basis for searching for information and selecting and organising information.

The development and use of databases created closer links between library and curriculum with benefits for librarian and teachers.

The microcomputer acted as a focus for issues relating to resource-based learning and information skills development as well as

the information retrieval process. The importance of the pupil's background knowledge and experience in information handling was highlighted and the need for a cross-curricular approach was recognised by teachers. Practical issues such as classroom and resource management in relation to project work were raised.

The report concludes that, to be effective as an educational tool, curriculum-linked databases should be developed from a clear statement of aims, based on the needs and abilities of users and the aims and objectives of the curriculum. Collaboration between librarans and teachers is essential in designing, developing and implementing the keyword approach. Careful planning of databases should take into account the keyword language, design and content of computer files. It is also important, however, to consider the practical issues surrounding the use of a microcomputer with large numbers of pupils.

All such issues should be considered in relation to pupils' work across the curriculum leading to development and reinforcement of skills on a long-term basis.

The main findings will be incorporated with case studies, examples of information skills exercises and guidelines on database creation in an information skills pack to be sent to all secondary schools in Scotland. This will be part of Phase 2 of MISLIP in which librarians and teachers in six secondary schools will adapt ideas and develop databases within their own curriculum.

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1. ORIGINS

1.1.
The project was proposed in the context of the developments in education, in school librarianship and in information technology. It sought to find common ground in these aspects of the learning environment.

1.2
Recent trends in education pointed to more individualised learning among pupils and to a greater use of resources within the context of that work. MISLIP arose out of an awareness that, in using information in libraries and elsewhere, pupils were often failing to meet certain ends desired by teachers. Research in education, such as that of Lunzer and Gardner (1) pointed to the need to develop within pupils skills such as reading for information and notemaking.

1.3
In school librarianship, much work has been done in the field of information skills, a term now used to cover such areas as library skills, user education and study skills. Work by Irving and Snape (2), Brake (3), Hounsell and Martin (4), Tabberer and Allman (5), Marland (6) and Herring (7) pointed to a need to examine information skills in the context of the school curriculum and across subject boundaries.

1.4
Developments in information technology, especially the advent of cheaper and more sophisticated microcomputers, allowed librarians and teachers to create databases (see Appendix 1) for use by pupils and the SIR project (8) examined pupils' use of such databases as an aid to selecting resources.

1.5
MISLIP originated from the need for research to examine the links between information skills and information technology within a school curriculum. Previous projects had either examined information skills in a number of schools or studied information technology developments in schools but had not looked at the use of the technology in the context of the information skills in a school's curriculum. The project was proposed to bring together the work of teachers, librarians and researchers to demonstrate that "information technology" should be seen very much in terms of the use of information as well as in terms of technology.

2. AIMS

2.1
The broad aims of the project were

to link information technology with information skills

to identify methods of helping pupils develop skills of defining purpose, finding and using information.

2.2
Within these broad aims, the project sought to

* design, develop and test an on-line bibliographic database in a school library, using a microcomputer

* examine methods of indexing materials on the microcomputer in relation to curricular subjects through the use of curriculum-based keywords

* introduce pupils to one example of the use of a microcomputer in accessing information

* develop within S1/S2 pupils the skills of identifying the purpose of information (educational or otherwise), of finding information and of using information

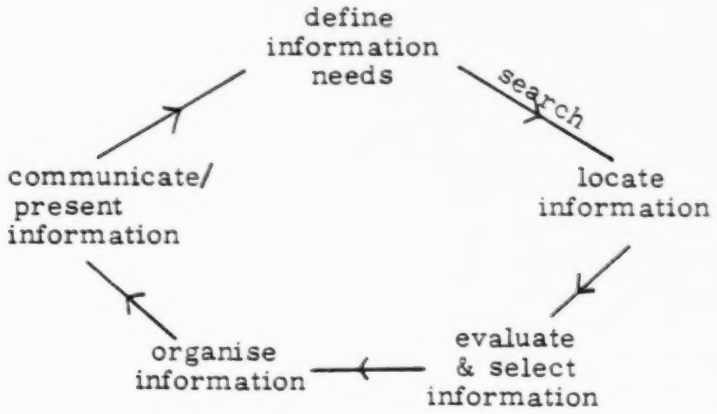
* to facilitate the development of information handling skills through the use of a curriculum-based information retrieval system

3. APPROACH

3.1
The project sought to investigate ways in which the microcomputer, and a simple database management package, could be used to help pupils develop information handling skills within the context of existing curricular activities.

3.2
The approach taken was to build on the aspects of the information retrieval system which would allow the development of a specific and flexible link between curriculum and resources. The search for information was seen as only one stage in the information-handling process in which information has to be located, evaluated, selected from resources, organised and presented in a purposeful way (see below) using appropriate information-handling skills.

The information process:



3.3
The use of curriculum-based keyword indexing of bibliographic databases was seen as a possible means of helping pupils maintain a clear sense of purpose between the "classroom" and "library" stages of the information search. Pupils would be provided with an information retrieval system which would allow them to make more specific and flexible searches by entering one or a combination of curriculum-based keywords into the microcomputer. At the same time pupils would be able to explore the relationship between specificity of search strategy and the quantity and quality of information retrieved, stressing the importance of thinking about purpose while encouraging the development of "classification" skills.

3.4
MISLIP was concerned with monitoring the effect of this keyword

approach not only on pupils' ability to retrieve information sources but also on subsequent stages of the information cycle such as reading for information, notemaking and organising information where a sense of purpose is needed in order to evaluate and select relevant information. The overall aims were to help pupils develop an awareness of the links between the stages of the information cycle, an ability to use appropriate skills at each stage to achieve their purposes, and an awareness of the use of a computer as an information-handling tool.

3.5
The project was based in one secondary school, allowing detailed investigation of curricular areas, pupils' work and the practical implications on a day-to-day basis. Throughout the project, there was close collaboration between teachers, librarian and researchers. This was true, not only in the development of databases to be used by pupils but also at the stages of observation and implementation of ideas. During the two years, it was possible to take findings from one set of observations and build them into the next stage of research.

3.6
The two broad areas of interest in the observation phases were

> the ways in which pupils used the information retrieval system and the effect of the keyword approach on their overall performance and understanding of the tasks in hand

> the roles and the important factors to be considered by librarians and teachers in designing, developing and using curriculum-based databases and a keyword approach to information handling in schools.

4. CONTEXT

4.1
The project was based in Bankhead Academy, a six year comprehensive secondary school, on the outskirts of Aberdeen. There is a strong emphasis on individualised learning within the school and the use of resources is seen as central to much of a pupil's work. From S3 onwards, pupils spend as much as one-third of their time in Private Study, working on assignments linked to each of their chosen subjects and often requiring to use departmental or library resources. This creates an obvious need for some confidence and proficiency in information skills.

4.2
Bankhead Academy has a purpose-built resource centre, with adjacent teaching areas arranged in an open-plan design. Within the library, pupils use print and A/V resources on an individual, group or class basis throughout the school day. Computers (one BBC-B, two Apples and one Spectrum) can be booked for class use or by pupils for use outwith class times.

4.3
At the inception of MISLIP, a one year Library Skills course, developed by the librarian with the cooperation of teachers, was being put into practice with S1 pupils for the first time. During the course of the following two years, the course was extended, firstly to cover notemaking and research skills as an option in S2 and finally into a compulsory S2 unit (see Appendix 2). All S1 and S2 pupils are timetabled for one double period (80 minutes) of Library & Information Skills instruction each week, working in the library with teachers from different departments.

4.4
MISLIP was seen as one means of linking the work done in the Library and Information Skills course with the work done in the classroom with a view to helping pupils develop the information skills needed for much of their work from S3 onwards.

4.5
The initial working base for MISLIP was the integrated studies course, Man : A Course Of Study (MACOS) for S1/S2 pupils. This course cut across traditional subject boundaries, presenting pupils with a range of multidisciplinary topics and concepts. MACOS involved pupils in a wide range of tasks requiring the finding and use of information. A common task was to watch a film or slide set, make notes on the content and then pose questions as the basis for class discussion or further research. More complex assignments included "research projects" in which pupils were asked to find information in the library, take notes, and use the information as the basis for a short talk to the class or a written report. Materials relevant to MACOS

were located in many areas of the library and the S1 teaching area.

4.6
MACOS therefore provided a very wide information base with cross-curricular links. It provided an opportunity to look at some of the challenges which pupils will increasingly encounter from S3 onwards in dealing with broad, overlapping themes and topics being introduced as part of current developments in Scottish education. It also enabled MISLIP to look at some of the problems being faced by school librarians in providing pupils with a means of access to resources relevant to these multidisciplinary themes.

4.7
During the course of the two year project, a number of departments became involved with MISLIP to varying extent. Some of the findings discussed below (see 6.1 - 6.4) have been based on work within S2 science, modern studies and humanities courses.

5. METHODOLOGY

5.1 Development

5.1.1
During the first year, time was spent in monitoring pupils' work in S1 MACOS classes. Detailed classroom observation and discussions with pupils and teachers formed the basis of an assessment of the information handling tasks of the course.

5.1.2
Comparison of classroom activities and work in S1 library skills led to the development of an outline information skills element to be integrated with S1 classwork. The aim was to extend the Library Skills course to cover aspects of information skills relevant to the keyword approach of MISLIP (See 3.3).

5.1.3
Exercises were developed to explore the concepts of diversity and quantity of information, defining purpose and information needs, "classifying" and relating information, searching for information (e.g. reading for information and using a database), summarising and organising information (e.g. notemaking, keyword mapping, labelling, database creation). All exercises were related closely to the keyword approach and sought to demonstrate common concepts and techniques in handling information. The skills encompassed in the exercises were seen as relevant across the curriculum and in any situation in which the pupil is asked to find or use information.

5.1.4
Many of the exercises were produced in the form of brief notes explaining aims and objectives and outlining ideas. Some of the exercises were incorporated into S1 classwork by five MACOS teachers during 1984/5.

5.1.5
Classroom observation also formed the basis for the collection of keywords to be used as indexing terminology for a MACOS database.

5.1.6
Throughout the project, bibliographic databases were developed using Keyword Information Retrieval System (KWIRS) software with an Apple 2e microcomputer. Information was collected for several files (see Appendix 1) for the MACOS course. Some were only partially completed, however, since emphasis was placed on creating files which would be used within the time scale of the project. These files can be completed and updated if required during 1985/6. (An example of a record in the MACOS database is shown in Appendix 3.)

5.1.7
Science, modern studies and humanities courses provided an opportunity to work with S2 pupils engaged in projects which involved the finding and use of information. Bibliographic databases were constructed for several of these project topics. (An example of a record in the database created for an S2 humanities project is shown in Appendix 3)

5.1.8
During the project, computer files were constructed by the librarian for fiction work in S1 library skills as well as non-fiction bibliographic databases for projects in the S2 health education and S4 modern languages courses.

5.2 Evaluation

5.2.1
Evaluation of the information retrieval system and the effect of the keyword approach to information skills was based on observation of pupils' use of databases, progress in information handling assignments and feedback from teachers on the outcome of information skills exercises.

5.2.2
The effect of the microcomputer and keyword approach was informally assessed in terms of pupils' attitudes to assignments and their ability to locate, select and organise information relevant to the purposes of the assignment.

5.2.3
Much of the information came from project work in S1 and S2 courses. The fact that discrete assignments could be monitored was helpful in that it allowed specific detailed questions to be asked of pupils and teachers. Pupils were able to reflect back to a recent and specific experience enabling them to discuss examples of finding and using information as well as the complete cycle of the information process.

The main S1 and S2 projects monitored were:

* S1 MACOS "Achievements" project - pupils were asked to research some aspect(s) of the life of a character who had carried a skill or talent to the limit of his/her ability;

* S2 Science - a project on some aspect of Streamlining in the natural world or in man-made objects leading to the production of a poster or booklet presentation; some pupils were taking part in the Health Education project on "Food" at the same time;

* S2 Humanities - a project in which pupils were asked to research some aspect(s) of the life of one of three characters associated with human rights movements;

In addition some feedback was obtained from discussion and brief observation during the following assignments:

* S2 Modern Studies - pupils were asked to define and research into important aspects of survival in the wild;

* S2 Health Education - a project in which pupils had to research and write up about some aspect of food they were particularly interested in.

5.2.4
Records were made of search strategies (see Appendix 4), confidence in handling the microcomputer, successes and problems encountered in finding and using information and evidence of the use of keywords and "classification" at each stage of the assignment.

5.2.5
Pupils and/or teachers were interviewed informally after S1 MACOS, S2 science and S2 humanities projects. These interviews covered attitudes to project work, problem areas and difficulties in handling information, attitude to and ability to use the information retrieval systems and a keyword approach.

5.2.6
Two class discussion sessions were held with teachers present, covering some of the points outlined in 5.2.5 as well as more detailed discussion of the kind of information and the layout of the information included in database entries.

5.2.7
A diary of observations, discussions and progress was kept throughout the project, providing records of sources of keywords, important stages and problems in the construction and use of databases, approaches and introductions to project work, progress of pupils in information handling assignments, and factors influencing the development of MISLIP within Bankhead over the two year period.

6 FINDINGS

6.1 Pupils

The effect of the keyword approach on pupils' work is considered in terms of:

- pupils' reaction to and ability to use the information retrieval system;
- the effect of the keyword approach on pupils' information retrieval skills;
- the effect on pupils' ability to define clear purposes, locate and select relevant resources and information, and to organise information in a meaningful way;
- the practical issues influencing pupils' information handling ability.

The findings are derived from observation of pupils at work and from discussion and interviews with pupils, teachers and the school librarian.

Using the information retrieval system

Database creation and use of a fiction database were useful introductions to the information retrieval system.

6.1.1
A database creation exercise in S1 MACOS helped pupils develop an understanding of the structure of the databases they went on to use in the library. Pupils in six classes created small factual databases as part of the information skills work based around existing MACOS tasks. Information on animal lifecyles was gathered from MACOS booklets, tabulated and the tables used as the basis of entries in a computer file. Each pupil, therefore, selected information, "labelled" it with relevant keywords and entered it in the class database using the KWIRS program. Pupils were encouraged to search the database for further information thus introducing the link between structuring and retrieving information.

6.1.2
Teachers saw the database creation exercise as a useful introduction for pupils to the concepts of an information retrieval system. Pupils referred to this experience several months later when asked about the use of the microcomputer after project work.

6.1.3
Experience in using a fiction database in the library was a useful introduction to the use of bibliographic databases. From the first term of S1 Library and Information Skills, pupils learned to search and enter information in a fiction database, designed and created by the librarian. Searches were mainly confined to single keyword searches in these early stages but continuing use over a period of time allowed pupils to become familiar with the KWIRS program before moving on to the use of non-fiction bibliographic databases.

Pupils quickly mastered the steps involved in using the information retrieval system.

6.1.4
Pupils generally ignored written instructions which were prepared at the request of teachers before the first use of a non-fiction database. Teachers had felt that some written instructions would be needed by pupils in using the computer as part of project work. In practice, however, pupils quickly mastered the steps involved in loading the program and files and searching a database. Guidance was limited to written instructions in Library and Information Skills classes followed by brief reminders within the context of classroom introductions to a new assignment (see 6.2.13 - 6.2.14).

Pupils developed an awareness of an information retrieval system by experiencing its use in a number of different contexts.

6.1.5
By using the information retrieval system within a number of different contexts pupils developed an awareness of the general concept of using a computer to store and retrieve different kinds of information. During the course of the database creation exercise several pupils referred to similar uses of a microcomputer in primary school in organising information about, for example, football teams. Some pupils also mentioned the use of the same kind of program by parents (usually father) on a home-based computer. Further recognition of the information retrieval role of the computer was shown when pupils began to ask the librarian for computer files at the beginning of new "research" assignments (see 6.3.16).

Information retrieval patterns

Three general search strategies were noted amongst pupils using bibliographic databases.

6.1.6
The main uses of non-fiction bibliographic databases took place within

S1 and S2 "research projects". Three general categories of search strategies were noted:

a) specific - pupils immediately decided to combine two or more keywords. In the S1 "Achievements" project, for example, the words used were usually the name of their chosen character and one aspect of their life such as "childhood" or "family".

b) broad - pupils decided to base their initial searches on one or, occasionally, on two broad keywords. In the case of the "Achievements" project this was often the name of a chosen character and the sport or mode of performance for which the character was famous. This type of search strategy usually retrieved all the references to the character in the file and often too much information for pupils to cope with.

c) browse - pupils elected to carry out a broad search to enable them to browse through entries for more specific ideas to follow up. In the case of the "Achievements" project, for example, pupils browsed through the entries relating to a field of achievement and selected an interesting looking character for their project. When this type of search strategy arose out of a negative type (a) or type (b) search it was often at the instigation of pupils themselves. In several instances, where pupils had difficulty in thinking of any interesting subject in the first place, such a "browsing search" was suggested by the teacher.

Experience and information skills background influenced search strategies.

6.1.7
A mixture of type (a) and type (b) searches were observed in all project work although the balance was seen to move towards more specific searches when pupils had more experience in using the database and/or had more extensive background in information skills from S1 onwards. In the case of the S1 "Achievements" project, for example, it was noticeable that there was a higher incidence of successful type (a) searches than had been the case in an earlier S2 pilot exercise in using a database where type (b) searches were more usual. One influential factor in this case appeared to be the MACOS-linked information skills work which had been designed to develop an awareness of the importance of purpose in finding and using information and had looked at the value of questions and keywords in defining purpose.

Pupils coped with the output from a broad search with varying success.

6.1.8
Pupils who began with broad type (b) search strategies coped with further selection of resources and information with varied success and guidance was usually needed. This is the type of search most similar to a traditional catalogue search where a broad search is followed by narrowing down each category in successive stages. After discussing possible options, some returned to the computer and searched again using different and/or a combination of keywords to narrow down their list of references. Others preferred to work from the print-out of references from the first search, using keywords and/or notes displayed in each entry to try to select some relevant items.

6.1.9
Pupils who returned to the computer to narrow down their search by combining terms based on their own questions and plans, were more able to cope with the problem of "too much information" than those who decided to "pick out" what was needed from the first print-out. Again the latter process of selection is not unlike the task facing users of a more traditional catalogue.

6.1.10
S1 pupils found the process of selecting from the print-out difficult. Even when they were aware that the keyword descriptors would be helpful in further selections and were encouraged to mark or highlight useful references, it was obvious that they did not, or were reluctant to, make any systematic selection. This process was more successfully accomplished by S2 pupils, particularly those whose background included S1 and S2 Library and Information Skills, who used keywords, notes and subheadings to guide selection from lists.

The classroom introduction to the assignment influenced information retrieval patterns.

6.1.11
The effect of the classroom introduction was most clearly seen in the S2 science project on "Streamlining". Pupils had had instruction in using the library and resources in S1 Library and Information Skills but only a small proportion had taken the S2 optional course and none had been involved in the MACOS-based information skills work. For these pupils, time spent in discussing the structure of a topic and helping pupils define their own purpose and needs had a marked effect at the information retrieval stage.

6.1.12
Several science classes spent very little time planning the assignment or discussing information retrieval in class and pupils arrived in the library with only a broad title in mind. They tended to select

keywords from the checklists (see Appendix 5) at the computer and/or those displayed in database entries. Searches tended to be broad and there was very little evidence of multiple keyword searches. Teachers reported that there were many problems with searches producing "too much information". One teacher thought that the background knowledge of the topic had not been adequate to enable pupils to cope with ensuing research stages.

6.1.13
While the computer generated much enthusiasm in the initial stages of the project, motivating many to begin to follow up some vague ideas, interest was quickly lost amongst many of these pupils in later stages of their work. Lack of clear purpose was evident at the stages of notemaking. Pupils often did not appear to be following up references from the computer, many browsing on the shelves having filed their print-outs in their work folders at the end of the previous lesson.

6.1.14
Two science classes were given a brief introduction to planning a project and using a database followed by more detailed planning sessions when they were encouraged to jot down some questions and keywords for their chosen research topic. Pupils in these classes had a better understanding of the techniques of structuring keyword searches and, in selecting keywords, were more able to combine terms which were relevant to their purpose. Pupils in this group made several successful searches combining three keywords. A typical search tended to produce a manageable number of references (a maximum of 7-9 items, with many searches producing only 2-4 references), without the need for further narrowing. Where guidance was needed, pupils were quick to grasp the ideas behind searching the database. They worked well in a busy library, and most had a clear sense of purpose while reading and notemaking.

Defining purpose

A more structured approach to project planning helped pupils find and use information.

6.1.15
Pupils benefited most from classroom introductions which involved the use of structured planning sheets based on the techniques used in S1 MACOS-linked information skills exercises, including the "Achievements" project. The aim was to encourage pupils to make and record decisions about their own work and to focus attention on purpose in finding and using information. Pupils were taken through the stages of selecting a topic, making notes of things they already knew, formulating questions and selecting keywords from the questions to guide their research. Pupils were encouraged to begin to structure search strategies in class, using the keyword list as a checklist, before moving to the library to locate resources.

6.1.16
A favourable reaction was obtained from the teacher and pupils who piloted this approach in the S2 "Streamlining" project and, as a result, the sheets were adapted for use in the S2 humanities project. A similar approach was also taken by teachers designing modern studies ("Survival") and health education ("Food") assignments.

6.1.17
Much of the success of the planning sheets stemmed from a clearer definition of purpose on the part of pupils when they began their information searches. Important factors in the process appeared to be the time devoted to planning (and thinking), the step-by-step approach of the planning sheets and the fact that pupils were making and recording their own decisions and ideas.

6.1.18
At the information retrieval stage, pupils showed a greater sense of purpose and greater confidence in structuring keyword searches than had been the case with most science classes. This was particularly true of the humanities classes where, despite the usual range of broad and specific searches, two or three keywords were frequently combined in well thought out strategies.

6.1.19
There was less evidence of pupils selecting keywords at random from the list as had been noted in some of the other, less well prepared, groups. Instead, pupils tended to use the keyword list as a checklist for their own keywords before using the database. In the humanities project several pupils added alternative words to their own keyword plan without prompting. This helped them retain their original purpose while allowing some alteration of search terms if required. In later assignments all pupils were encouraged to go through this step on paper.

<u>"Mapping" and "classification" exercises helped pupils develop useful search strategies.</u>

6.1.20
"Mapping" (See Appendix 1) of keywords and phrases was introduced in notemaking, summarising information and planning in MACOS-linked information skills exercises and in S2 Library and Information Skills. Feedback indicated that this was a popular technique with pupils and keyword mapping was encouraged in the planning sheets. As a planning tool it helped many pupils structure their ideas and design useful search strategies as well as helping them organise information later in the project (see 6.1.29 - 6.1.31). This was more successful when pupils based their maps on their own knowledge of the subject

initially rather than selecting and arranging keywords from the database checklist.

6.1.21
In the humanities some pupils followed up their initial mapping by arranging "approved" keywords in separate clusters of related terms representing search strategies. As well as encouraging them to record personal decisions at each stage, this "classification" process gave pupils a clear sense of purpose in searching the database. Those who completed this stage usually made a number of specific searches in a short space of time each representing one aspect of their research topic.

6.1.22
It was clear from discussion with teachers involved in designing modern studies and health education assignments that they considered it beneficial for pupils to spend time clustering and grouping related keywords at the planning stage of their projects. This "classification" exercise was considered to be valuable in helping pupils explore and develop their own "picture" of the topic as well as developing a sense of "specific" and "general" relationships, an important but difficult concept for many pupils at this stage.

6.1.23
The "mapping" and "classification" approach was more time consuming and required greater guidance on an individual basis throughout the search process than might be the case where a thesaurus or prestructured keyword map is provided for searchers. In all the assignments monitored, however, teachers viewed the information search as an exploration of the relationships mapped out by the pupil and there was a positive reaction against the use of any prestructured thesauri. The latter approach may be seen as a useful alternative in catering for the use of databases on a more casual basis, where guidance is less readily available, or for more experienced users for whom the development of "classification" skills is seen as less important, or in a less open exercise where it might be useful to present concepts within the recognised framework of relationships in a field of knowledge.

<u>The microcomputer information retrieval system complemented the planning approach in a way which was not possible with the traditional catalogue.</u>

6.1.24
Pupils who attempted to use the traditional catalogue after the planning sheets encountered some difficulties. In the humanities project some pupils were encouraged to begin their searches by using the library catalogue, using the microcomputer database as a "back-up" when difficulties arose or "gaps" in knowledge were identified. This

was an attempt by teachers to encourage a direct comparison between the two systems and to introduce greater freedom for pupils at the information retrieval stage.

6.1.25
Several pupils experienced difficulties in using their chosen keywords as search terms in the catalogue when the only obvious point of entry was the name of the character whose life they were researching. They were forced to broaden out from their original purposes, making it difficult for them to extract relevant information from the resources. At the same time they tended to miss useful material (print and A/V) by focussing their attention on only one section of the library, in this case the biography section.

6.1.26
This problem was compounded by other difficulties associated with pupils' use of the catalogue generally. They often moved directly from the subject index to the shelf, missing out the author/title sequence, so that they were only aware of the resources that were on the shelf at the time of searching. Those who attempted to use the author/title sequence of the catalogue were often reluctant to make notes of more than one or two references. Thus pupils narrowed down their choice artificially by failing to use the catalogue fully.

6.1.27
In the humanities project, having defined some specific information needs, pupils became frustrated when they could not follow up their lines of enquiry as directly as possible. Some pupils abandoned the catalogue search at an early stage in favour of the microcomputer database which allowed the use of more specific search strategies.

6.1.28
Pupils who used the database as a "gap filler", usually having begun their research using one or more biographies, were able to structure their searches in a very specific way. Increasing knowledge and immersion in the subject meant that they were able to identify very specific things they wanted to know which they could then translate into useful search strategies. At this stage the computer provided a rapid and direct means of following up specific interests.

<u>Selecting and organising information</u>

<u>The keyword approach (planning and microcomputer) helped pupils in the later stages of their assignments.</u>

6.1.29
In science and humanities projects where a structured planning approach was coupled with the use of the microcomputer information

retrieval system, pupils generally handled the information gathering and presentation stages better than the less well prepared groups.

6.1.30
There was considerable evidence of the use of keywords and/or questions throughout each assignment. Some pupils, working in pairs, showed initiative in using the keyword descriptors listed under database entries to organise their research, each working on a specific aspect of their joint topic. Several pupils used keywords to help select items from print-outs which were too lengthy. Questions and/or keywords were used by pupils as reminders of purpose when skimming through books, scanning indexes or extracting relevant information from resources. Keywords were used to help organise notes and final presentations. They were often highlighted in text, used as headings or in labelling diagrams and illustrations.

6.1.31
The use of keywords and questions <u>after</u> the information retrieval stage was most noticeable in the humanities project. These pupils needed, and were given, less guidance generally than had been the case with the S2 science project, where a similar keyword approach had been taken. A growing confidence was noticeable in the way pupils handled the computer (needing little if any guidance), planned their own work and followed through the research stage.

<u>Experience in other areas of the curriculum was an important factor in pupils' ability to handle information in an assignment.</u>

6.1.32
In each of the S2 projects it was noticeable that previous experience in Library and Information skills was an important influence on pupils' ability to find and use information in project work. Pupils in the S2 humanities project who had had a more extensive background in information skills than any other group, including more curriculum based work, displayed greater understanding of the processes involved in finding and using information. They were also more confident in discussing and evaluating their own work in terms of process as well as content. The fact that several of the teachers had also been involved with the S1 Library and Information Skills course meant that pupils could be reminded and encouraged to transfer skills more readily than might have been the case in other courses.

6.1.33
The timing of an assignment in relation to other work was also important. In all science classes pupils who had had recent experience of a similar "research project" in S2 Health Education or had taken the S2 Library and Information Skills option, showed more confidence and initiative in organising their work and making decisions than many other pupils. In the absence of any detailed

planning and guidance pupils benefited from such experience and were able to transfer skills and ideas more easily than those who were more reliant on S1 Library and Information Skills training. Pupils themselves identified areas in which they felt they had been able to use knowledge and skills gained from previous work and it was evident that they were gaining in confidence in discussing problems and difficulties they recognised in their own work.

6.1.34
Where a gradual build up of skills was coupled with a keyword approach to the project as a whole, pupils showed greater awareness of the information-handling process. The planning process and the use of the information retrieval system helped them define and maintain a clear purpose which they then had the ability to follow through over a period of time.

Practical issues

Pupils' sense of purpose was influenced by practical considerations.

6.1.35
Removing resources from the library during project work created problems for some pupils. In the S2 science project, for example, pupils in some classes were encouraged to return to the classroom to read and make notes from the library resources. The effect of physically separating location and use of resources, combined with the need for pupils to move between classroom and library (a journey taking several minutes in this case) at least twice in each lesson, appeared to contribute to the poor performance of many pupils compared to those who used resources in the library.

6.1.36
Where there was a lot of movement between classroom and library a lack of purpose became evident early in the searches for information. Many pupils appeared to lack any clear idea of what they were looking for and tended to "drift" away from their original purpose. Although these pupils had not used planning sheets, they had been encouraged to prepare lists or maps of keywords on paper before the computer stage of their searches. Many, however, tended to broaden out from their original purposes when left to work independently at the computer. It was also noted that several pupils had already lost or forgotten to bring their written plans with them to the library and were selecting keywords at random from the keyword checklist. Such lack of clear purpose may have been an important factor at the notemaking stage when many were inclined to make verbatim copies of large pieces of text.

6.1.37
The removal of resources to one or more classrooms during the course of a project contributed to another source of frustration and

"drifting". It was noticeable in the S2 science project that many pupils had difficulty in locating resources on the shelf. Some of this difficulty was undoubtedly due to the large numbers of pupils attempting to work in the same specific field for which there were, as a consequence, too few resources (see 6.2.18 - 6.2.19). Where several classes were working on the same piece of work, however, the problem was made worse by the removal of resources to one or more classrooms. This problem was highlighted by the use of the computer as pupils became more aware of specific resources than is often the case when the traditional catalogue is used (see 6.1.26).

Planning sessions helped to prevent queueing and allowed pupils to make the best use of their time at the computer.

6.1.38
The time spent in the classroom in the initial planning stages of an assignment was of practical benefit to pupils at the information retrieval stage. When one or more classes were engaged on the same assignment, with only one or two microcomputers available, it was important to avoid excessive queueing at the computer. It was helpful when much of the thinking and planning were done in the classroom. By spending time discussing decisions and making plans on paper, under the guidance of the teacher, pupils tended to be ready to begin their information searches at different times. This reduced the numbers of pupils who were likely to be waiting to use the computer at any one time.

6.1.39
Careful planning and discussion also clarified purpose before the information search leaving pupils free to spend their time at the computer profitably. Time was spent searching the database and making any obvious alterations to search terms while major decisions and alterations to plans were carried out away from the computer.

The printer was an important in preventing queueing at the computer.

6.1.40
The printer was valuable in practical sense where large numbers of pupils were using one or two computers. Although pupils regarded it as important for other reasons (see 6.1.47), teachers and librarian saw the printer as helpful in reducing the amount of time needed at the computer and encouraging pupils to move on to the next stage, the location and evaluation of resources.

Pupils' views

Both the planning sheets and the microcomputer were helpful in defining purpose, finding and using information.

6.1.41
In discussions and interviews after science and humanities projects many S2 pupils were able to discuss their work in some detail not only in terms of content but also the skills and decisions involved at each stage of the information process. They could often identify skills which they felt they lacked or needed to improve, as well as being aware of things they had learned in Library and Information Skills which had been helpful in their project work.

6.1.42
The planning sheets and the microcomputer were felt to have been helpful in the initial stages of a project. Although pupils enjoyed having the freedom to "choose your own topics" some spoke of the difficulty of "getting started". The planning sheets had helped them decide what they wanted to find out about and the microcomputer gave rapid feedback in terms of resources and, for some pupils, provided ideas about possible topics to explore.

6.1.43
No single process was isolated by all pupils as being most difficult. Some thought that selecting information from a book and/or notemaking were more difficult than, for example, "writing it in my own words". Again, some of those who had used project planners said they found it useful to review their own original purposes before scanning an index or making notes from a book or filmstrip. They recognised that it was easier to select information when "you knew what you were looking for" and most felt that the planning sheets had helped them decide what they were interested in.

Pupils preferred the microcomputer to the traditional catalogue.

6.1.44
All S1 and S2 pupils interviewed said they found the microcomputer information retrieval system as easy or easier to use than the library catalogue and most expressed a marked preference for the computer. Pupils liked the directness and immediacy of the information, the fact that a full list of resources was produced in each search, and that it was "faster" than the traditional catalogue. Some appreciated the presence of page references, some liked the idea of having notes about each item in a database. Two boys in one S2 class commented that the microcomputer was good for "getting started" with the project but they would prefer not to have page references since it was better to have more freedom in selecting information from a book. (The teacher considered the problem in this case to have been one of reading skills rather than need for greater freedom.) Others said that the microcomputer was more useful later in the project when specific

information was needed quickly.

6.1.45
In discussing information retrieval, many pupils said they could use the catalogue if they had to although, in practice, pupils frequently appeared to use only the subject index (see 6.1.26). Many found that the traditional catalogue was difficult to use and complained that it was time consuming.

The printer was important part of the information retrieval system.

6.1.47
The printer was regarded by pupils as an important part of the information retrieval system. They appreciated not having to make notes of references from a catalogue. They also talked of using the information on the print-out in various ways throughout their project. These included using the keywords and/or notes in the print-out to narrow down their search, to broaden out by exploring areas related to their original enquiry, to help divide the workload within a group assignment and to provide ideas for headings. On several occasions part or all of a print-out was included as part of the written presentation.

Practical problems were a source of frustration.

6.1.48
Many pupils spoke of the frustration of books not being on the shelves. This had been the case when large numbers of pupils were involved in the same assignment (see 6.2.18 - 6.2.19). Difficulty in locating resources had not, however, been solely due to lack of materials (see 6.4.23) but the problems identified by the researcher and teachers were not recognised as problems by pupils.

Pupils considered that they learned more by working independently.

6.1.49
It was clear that most pupils enjoyed project work and appreciated being allowed to work on your own. They also felt that they learned more by "finding out yourself" than they did by "just sitting and listening to the teacher". In some cases their involvement in their work was clear when they spoke of using outside resources. Several spoke of finding information in books or magazines at home, some had asked a parent or another member of the family who "knows all about it". Much of this involvement with their work was confirmed by teachers who felt that every effort should be made to help pupils develop the skills and confidence needed to learn for themeselves.

Summary

6.1.50
The following points summarise the reaction of pupils to the keyword approach and its effects of their ability to handle information in a purposeful way:

* Pupils found the information retrieval system easy to use and preferred it to the traditional catalogue;

* A database creation exercise and the use of a fiction database in S1 were helpful in introducing many of the concepts of a computerised information retrieval system;

* The information retrieval system helped pupils select topics for study, define purpose, locate relevant resources;

* "Mapping" and "classification" exercises helped pupils define purpose, develop useful search strategies, select relevant information and organise information;

* The combination of the information retrieval system with a planning approach which emphasised definition of purpose for the whole assignment was helpful not only at the information retrieval stage but also in the difficult process of selecting relevant information;

* Pupils performance in information-handling assignments was influenced by factors such as the classroom introduction to the assignment, information skills background and practical "management" of the assignment;

* A gradual development of skills in the Library and Information Skills programme and curriculum-based activities helped pupils develop awareness of and confidence in the processes involved in finding and using information.

6.2 Teachers

Teachers' views on the use of the keyword approach are considered by examining:

attitudes to information skills development within and across the curriculum;

reactions to the use of the microcomputer information retrieval system;

the use of the information retrieval system within curricular assignments;

teachers' involvement in the development of curriculum-based databases;

reactions to pupils' use of databases in project work;

issues affecting pupils' performance in information-handling assignments.

Views and comments were invited from teachers at every stage of the project. It was not possible to timetable regular meetings throughout the school year but feedback from teachers on information skills exercises, development and use of databases, and information handling in "projects" was gathered in informal interviews and discussions.

Information skills in the curriculum

Teachers recognised the need for pupils to develop information skills across the curriculum.

6.2.1
Discussion with MACOS teachers early in MISLIP indicated a recognition of the need for pupils to develop information skills such as notemaking and more flexible reading strategies. Classroom observation and discussion with teachers throughout the project, indicated that some teachers in different areas of the curriculum were already exploring ways to help pupils develop particular skills. Active participation in research such as that of Fyfe on reading (9) and Nisbet and Schucksmith on "Learning strategies 10-14"(10) had been influential in focussing attention at Bankhead on the way pupils learn and MISLIP was viewed in the context of classroom exploration which had resulted from such work.

6.2.2
Cross-curricular interest in information skills was reflected in the

active involvement of several departments in the development and teaching of the Library and Information Skills course. Teachers from various subject areas had been involved with the librarian in planning the free-standing S1 Library and Information Skills course. During 1983/4, a new optional S2 Library and Information Skills course was devised to cover such skills as notemaking and research work. This course has now become a compulsory module for all pupils and is taught within the timetable of the S2 humanities course.

<u>There was consensus amongst teachers about the skills required to handle information in different subject areas.</u>

6.2.3
A favourable response was received from teachers from different departments who took part in a workshop on information skills. The aim of the workshop, organised as part of MISLIP, was to encourage teachers from different subject areas to discuss the nature of information skills within their own departments and to stimulate some cross-curricular comparisons. The workshop also attempted to introduce some of the thinking behind the keyword approach by means of a small practical exercise linked to the use of a database. Although discussion was brief, teachers welcomed the opportunity to explore these issues with colleagues from other subject areas.

6.2.4
An important factor which emerged was the consensus of ideas on the broad categories of information skills needed in different subjects as well as the definition of some skills specific to particular areas of the curriculum. The skills identified as being relevant to handling information in different subjects all fell within the areas of finding, evaluating and selecting information and information sources, organising and presenting information.

6.2.5
This workshop was seen as the first of several which would have sought to develop areas of particular interest to teachers but, due to the current industrial action in schools, it was not possible to continue with this programme. Nevertheless, it served as an indication of the interest of individual teachers across the curriculum in information skills. It helped those who had previously expressed some uncertainty about the nature of information skills, by indicating to them that their own definitions or ideas in relation to their own subjects were in fact valid on a much wider basis. It also reassured some that information skills were not necessarily linked to the use of a computer but were of much wider significance.

Developing information skills within the curriculum

Curriculum-based exercises were useful in developing skills of defining information needs and "classification".

6.2.6
The keyword approach was used as a focus for the development of a curriculum-based information skills element aimed at extending and reinforcing the free-standing Library and Information Skills course. There was a concentration on defining purpose and "classification" in relation to aspects of finding and using information. These were seen as skills underlying many information-handling processes and which could be more adequately handled when linked to "real" information needs within the curriculum than to a free-standing library-based course.

6.2.7
Many of the ideas were received with enthusiasm, particularly those which explored the "classification" of information through the construction of word maps. The exercises were adapted for use in existing classroom tasks by five S1 MACOS teachers. Ideas which have proved useful and popular have since been integrated with other areas of the course and links have been built up with the S2 curriculum by through project work in humanities and modern studies. There is increasing interest among teachers in further integration of library and curriculum-based aspects of information skills development.

A flexible approach was needed in the development of information skills within the curriculum.

6.2.8
Important practical factors emerged in the course of the first implementation of exercises in S1 MACOS. Teachers were aware of the difficult balance which needed to be struck between the development of content and skills within any one lesson. Teachers preferred to work from brief outlines of ideas and aims rather than detailed notes linked to particular areas of the course. This allowed them to vary the time and approach to suit individual classes although this involved a potentially greater amount of preparation time. Exceptions to this, however, were exercises which involved the microcomputer. These were more structured and linked to particular parts of the course and it was noticeable that any use of bibliographic databases outwith class time was usually at the suggestion of the pupils themselves rather than the teachers. This may have been due to teacher's apprehension about their own understanding of the information retrieval system (see 6.2.10). It is interesting in this context that teachers took very little part in the S1 database creation activity (see 6.1.1) while recognising that it was a useful experience for pupils.

The information retrieval system

The first use of a database by pupils created further interest amongst teachers in different subject areas.

6.2.9
The use of the fiction and S1 MACOS databases gave rise to further interest and active involvement on the part of teachers. The ideas behind the use of the information retrieval system were seen as interesting and relevant by teachers and some suggestions of further involvement in various subjects were taken up as part of MISLIP. As a result databases were constructed by the researcher or by the librarian, providing useful feedback at a point when changes in the structure of the S2 curriculum meant that it was difficult to make plans for an S2 database in the integrated studies course.

A concentration on application rather than technology helped overcome initial apprehension about the use of a computer.

6.2.10
Teachers often expressed apprehension about their own ability to handle the computer although they were confident that pupils would have no such fears. Some of this worry appeared to be centred on the use of disks rather than cassettes with which they were more familiar. Other factors may have been the use of a computer which they were less likely to have used in the classroom (i.e. an Apple 2e) and also the mistaken assumption on the part of some teachers that programming skills were necessary. In most cases, fears were dispelled once a small file of references relevant to their own subject could be demonstrated, focussing attention on information rather than technology.

Development of databases

Small demonstration files were helpful in discussions about design and indexing of databases.

6.2.11
In the development of databases, teachers were asked to comment on layout and content of small (5-10 entries) bibliographic files linked to each topic. This was found to be useful in discussing the design and indexing of database entries and helped overcome the problem of talking in abstract terms about a system which was unfamiliar to most teachers.

Identifying keywords was a useful process for teachers.

6.2.12
In all S2 files, teachers provided the inital keyword indexing terms and two reported finding this exercise useful from the point of view of looking in detail at the concepts and relationships embedded in each topic. It was interesting that, in two cases, teachers used word maps to display keywords at this stage.

The use of databases was gradually integrated into the classroom introduction to the whole assignment.

6.2.13
Initially, most teachers felt that some introduction and guidance should be given by the researcher or the librarian before the use of each new database. The chosen approach was to discuss with pupils any previous experience of a database as well as the importance of defining purpose and information needs, an approach which it was felt could be structured into the timetable of a practising librarian. In the later stages of MISLIP, however, there was a growing confidence among teachers in using the information retrieval system and the introduction and planning stages were seen as something which could be done within the context of a classroom introduction to the whole assignment. The library staff, on the other hand, continued to be seen as experts in terms of creating files and guiding pupils where help was needed during interrogation of the database.

6.2.14
Teachers initially felt that pupils would need some written guidance in using the computer and the KWIRS program, possibly reflecting their own apprehension about the system. They selected a flow chart from three formats of instruction sheets prepared before the first use of a non-fiction database. In practice, however, such instruction proved to be unnecessary for pupils (see 6.1.4) except in their first uses of the information retrieval system. Early feedback on the KWIRS program which led to alterations to the Apple version of the program are reported elsewhere (6.4).

Using databases

The use of databases was seen as a motivating influence in helping pupils define information needs and purpose.

6.2.15
Use of databases in projects was viewed favourably by most teachers. It was seen as a motivating influence for many pupils, encouraging them to structure vague or broad topics into a tighter, more defined statement of purpose in the initial stages. Some teachers identified this as a problem associated with project work generally in that

pupils tend to select very broad titles leading to problems when they have no specific purposes to help in later stages of evaluating information. The microcomputer was seen as something which could be used to try to solve a deeper problem than that of the immediate search.

6.2.16
Some teachers were worried when searches produced a wider range of references than were needed (type (b) search in 6.1.6) but this was seen in other cases as a very effective demonstration to pupils of the need for a clearer definition of purpose. On the other hand, broad searches (type (c) in 6.1.6) were sometimes encouraged where pupils had difficulties selecting topics suitable for study.

The microcomputer encouraged a more effective use of existing resources.

6.2.17
Initially, some teachers expressed a fear that the information retrieval system would expose pupils to "too much information" and this was expected to pose problems after the location of resources. In many cases, however, pupils were seen to have benefited from being made more aware of the full range of resources available than is often the case in the traditional catalogue (see 6.1.26). In S1 MACOS and S2 humanities and science projects, some teachers considered that pupils had been encouraged to use a greater number and wider range of resources than might have been expected. This is consistent with the librarian's observations on the effect of the fiction database on the range of fiction borrowed (see 6.3.3).

The microcomputer highlighted problems associated with use of resources in project work generally.

6.2.18
Although use of existing resources increased, specific gaps in resource provision were highlighted as greater numbers of pupils became aware of the full range of resources available. The librarian and most teachers saw the problem as being linked to the large numbers of pupils involved in the same assignment at the same time.

6.2.19
The long-term solution was seen to lie in increasing the provision of resources in specific areas either from funds or from School Library Service loans. In the case of the humanities exercise, the problem of lack of adequate resources in some aspects of the subject was predicted in a pilot exercise in 1984/5 and provision of extra resources was made before the full scale project the following year. In other cases some teachers found it helpful to encourage pupils to

view the problem as one of the factors which should always be taken into account in the decisions which they need to take in planning a project. Only one teacher appeared see this issue as an argument against the use of the microcomputer.

6.2.20
The creation of databases for particular research topics was also useful in highlighting lack of A/V resources in some areas and teachers expressed an awareness of the need to increase stock in this area before the S2 humanities project in 1986/7. Such practical issues may be seen as important in project work as a whole but are particularly focussed upon when the computer is introduced.

The classroom introduction to an assignment influenced the over-demand on specific resources.

6.2.21
Another factor which was felt to be influential in creating an over-demand in the science project was the introduction to the project which tended to focus the pupils' minds on specific examples of streamlining upon which they then based their information searches. A broader base of knowledge or more guidance in the early stages may help in this situation. One teacher expressed the opinion that previous knowledge had perhaps not been sufficient to enable pupils to select a useful topic or to spread the load of topics covered so that resource provision would be adequate.

Information handling in projects

The microcomputer and planning sheets were seen as valuable aids to information retrieval and later stages of an assignment.

6.2.22
Most teachers recognised that pupils usually had problems in selecting relevant information, reading, notemaking and structuring information in the final presentation of an assignment. Drifting away from the original topic and copying text directly from resources were seen as evidence of difficulty in these areas. Where project planners were used, however, teachers were generally pleased with the amount of information gathered, the way pupils had organised the information and the amount they had learned while working relatively independently.

6.2.23
Where planning sheets were used in S2 science (see 6.1.15) the teacher concerned was enthusiastic about both the planning approach and the microcomputer. He thought that both had contributed to the success of the project. The planning sheets had helped pupils clarify purpose and aims before and during the assignment and the computer had acted as a

motivating influence as well as a means of moving quickly from plans to information sources. He felt the use of the computer had helped make the assignment "more active" for pupils.

The keyword approach was seen as part of the future development of information skills within the curriculum.

6.2.24
The planning approach, including mapping of keywords, is being built into further S2 humanities and S2 modern studies work. In the latter case, the "research planning" and the use of a database (prepared by the new librarian at Bankhead) have been fully integrated with the materials developed by teachers for the course. Even greater emphasis on development of search strategies and "classification" are seen as important by teachers. They also see a need to consider carefully the practical issues of managing assignments involving large numbers of pupils working with a limited number of resources and computers. Thus the "library" stages are becoming an integral part of the whole assignment for teachers and pupils.

Summary

6.2.25
The following points summarise teachers' reactions to and views of the keyword approach:

* There was a recognised need for information handling skills across and within the curriculum;

* The development of information skills within the curriculum required a degree of flexibility to cater for different approaches and needs;

* The ideas behind the information retrieval system and the keyword approach were seen as interesting and relevant by teachers in different subject areas;

* A concentration on "information" as opposed to "technology" helped overcome initial apprehension about the use of a computer on the part of teachers - a gradual build-up of confidence in using the information retrieval system led to fuller integration of the use of databases within classroom introductions to assignments;

* Teacher involvement in the design and development of curriculum-linked databases was essential to success and an interesting exercise in itself;

* For effective use of a database in project work, teachers recognised that there was a need for careful consideration

of practical issues affecting classroom and resource management;

* Teachers considered that the use of the microcomputer and a structured planning approach helped pupils develop skills of defining purpose, selecting and using information.

6.3 Librarian

The following points outline the reactions and views of the school librarian to the development and use of curriculum-based databases. The effects of the information retrieval system are considered in terms of:

the information-handling process;

attitudes towards the library;

the use of resources;

the relationship between library and curriculum and between librarian, teachers and pupils;

the development of pupils´ information retrieval skills;

pupils´ attitudes to and awareness of the computer as a tool.

The points raised are based on a report prepared for MISLIP by the school librarian.

The link between library and curriculum was considered important in the development of information skills.

6.3.1
MISLIP was seen as an initiative which focussed attention on the whole information process, developing links between the library and the curriculum in terms of resources and skills. The school librarian considered this to be an important aspect of the development of information skills and, with this aim, was involved in the planning and implementation of MISLIP as co-director of the project.

Use of the microcomputer enhanced the image of the library.

6.3.2
During the course of MISLIP, library staff (librarian and assistants) and the A/V technician were actively involved in creating databases (fiction and non-fiction) and in encouraging and helping pupils in the use of the microcomputer in the library. Over the two years library staff developed a reputation amongst pupils as "experts" in the use of the microcomputer. (Some pupils indicated that they regarded this as one of the most impressive aspects of the library!) This was seen as a

positive enhancement of the role of the librarian in what was already a very supportive environment.

The microcomputer encouraged the use of resources.

6.3.3
One of the developments initiated by the librarian was the introduction of a fiction database in the S1 Library and Information Skills course. This was seen as a way of reinforcing the aims of the Explorer Club, a scheme designed to encourage children to read a wider range of fiction. The librarian reported a marked widening of the range of fiction being borrowed by S1 pupils after the introduction of the database and the effect appeared to be a long lasting one. Coupled with observations on the use of non-fiction resources in project work (see 6.2.17) this indicated some benefits in terms of increased use of resources generally.

The creation of entries in a fiction database helped to introduce the information retrieval system to pupils.

6.3.4
As an extension to the popular fiction database, the librarian encouraged S1 pupils to create their own Explorer Club files. Pupils entered information on books they had read, giving brief descriptions, comments and bibliographic details, as well as "labelling" each entry with appropriate keywords. This was a slow process for most pupils but was considered by teachers and the librarian to be a worthwhile exercise, encompassing many of the skills of summarising and indexing information.

6.3.5
The creation of entries in the fiction database was seen as one stage in the process of introducing pupils to the concepts of a computerised information retrieval system. It was linked to an earlier exercise in MACOS when pupils created their own factual databases on animal lifecyclyes (see 6.1.1). These exercises allowed pupils to develop some of the skills needed to use the non-fiction databases in MACOS and S2 projects.

The creation and use of curriculum-linked databases

The time needed to create a curriculum-linked database was well spent from the point of view of the library and the curriculum.

6.3.6
Comments from the Advisory Committee and contact with other school librarians had indicated that one source of worry was the amount of

time needed to produce a useful non-fiction database. In order to assess the level of commitment required, the librarian worked with one teacher to create a database on "Food" for an S2 health education assignment. Over a period of two weeks she found sufficient time to build up a KWIRS file of over 100 references including brief comments about each resource.

6.3.7
The librarian felt that the time had been well spent as she had gained closer contact with the curriculum and with pupils, not only through the creation of the database but also in her active involvement in the health education project itself.

6.3.8
A questionnaire designed to cover the major factors in creating a database (see Appendix 7) was found to be useful in the development of the "food" file. It helped focus attention on the relevant points, thus saving time for both librarian and teacher.

The creation and use of databases helped the librarian identify specific gaps in stock.

6.3.9
The process of creating a database was found to be ueful in terms of assessing stock provision in the library. Through the detailed analysis of areas of the curriculum linked to pupils' "research assignments", the librarian was able to identify gaps in stock in a way which was not usually possible when working from more general outlines of courses. The use of databases in project work also highlighted areas of specific need which had not previously been spotted (see 6.2.18 - 6.2.20).

The library was brought closer to the curriculum through the development and use of databases.

6.3.10
Involvement in the development of databases and the Library and Information Skills course helped to create a closer liaison between the librarian and teachers. Interest in MISLIP stimulated by the first uses of the information retrieval system meant that the library was brought closer to the curriculum through the active involvement of teachers in subjects such as science and modern languages as well as those who had already been involved in the Library and Information Skills course.

6.3.11
The creation and use of databases led to a greater awareness of what

was happening in the curriculum. Working closely with teachers in the design of databases and, in particular, the development of the keyword indexing language, the librarian gained a deeper understanding of the curriculum and the specific information needs of pupils and teachers in a way which is rarely possible from considering the general outline of a topic or a course.

6.3.12
The research process itself contributed to a closer understanding of the curriculum and the needs of users. The librarian felt she had gained much from involvement in interviews and discussions with teachers and pupils during the course of MISLIP. During an organised discussion with teacher and pupils in the "Food" project, the librarian had an opportunity to assess for herself the impact of the database she had created as well as gaining further insight into pupils´ attitudes to the library.

<u>The library was a useful place to introduce the computer as a tool not linked to any particular subject area.</u>

6.3.13
The librarian felt that pupils had benefited from the provision of an information retrieval system which they found attractive and easy to use. They had also gained some understanding of the computer as an information-handling tool rather than a games machine or a programming instrument.

6.3.14
The library was seen as a useful place to introduce the microcomputer as an information retrieval tool. The "neutral" environment coupled with the opportunity to use databases in several dfferent contexts contributed to pupils´ understanding of the information retrieval system.

<u>The use of databases helped pupils develop information retrieval skills generally.</u>

6.3.15
The librarian was aware of an effect of the microcomputer on the way in which pupils used the library catalogue. They began to have higher expectations of what a catalogue could do and what they wanted it to do. They also learned how to expand searches in the traditional catalogue by exploring the relationship between topics in the microcomputer.

6.3.16
Pupils began to compare the conventional catalogue with the

computerised "catalogue" and expressed preference for the depth and direction given in the computer files. Their preference for, and awareness of, the microcomputer as an information retrieval tool was evident when they began to ask the librarian for computer files on topics such as "art" and "painters".

Further developments

6.3.17
The librarian is now working on KWIRS and viewdata files in her new school. At Bankhead the development of non-fiction databases has been taken up by the new librarian.

Summary

6.3.18
The following points summarise the librarian's reactions to and observation of the effect of the keyword approach:

* The creation and use of databases brought the library closer to the curriculum and the needs of users, a link which the librarian considered important in the development of information skills;

* The use of the microcomputer enhanced the image of the library and created interest among pupils and teachers;

* The use of the microcomputer information retrieval system encouraged wider use of fiction and non-fiction resources;

* The planning and development of databases and the Library and Information Skills course created a closer liaison between the librarian and teachers;

* The process of creating a database helped to highlight specific gaps in library stock in a way which was not usually possible;

* The library provided a useful environment to develop an awareness of the computer as an information handling tool rather than as a games machine or as a programming instrument;

* The librarian was aware of pupils' development of information retrieval skills, reflected in their awareness and use of traditional as well as computerised information retrieval systems.

6.4 The information retrieval system

The factors and issues of importance in the development and use of the information retrieval system are considered in terms of:

the hardware and software requirements;

factors involved in the design and development of curriculum-linked databases;

teacher and librarian involvement in the development and use of databases.

The points examined below were those which emerged from observations and discussions between the researcher, the school librarian and teachers during the development and use of databases.

Hardware and software

6.4.1
Feedback from teachers, pupils and school librarians was taken into account when considering the requirements of the information retrieval system (hardware, software and information).

Small alterations to the software made it simpler for pupils to use with little formal instruction.

6.4.2
The information retrieval program used throughout MISLIP was the Key Word Information Retrieval System (KWIRS) which had been produced in Grampian Region for use in schools with Apple 2 or 2e microcomputers. KWIRS had been developed with S1 pupils in mind and was relatively simple and self-explanatory. During the course of the project, the program was amended in line with comments and observations. Changes to position of single line messages on the screen and the layout of keyword retrieval features resulted in a program that required no further written instruction other than pupils' introduction to the information retrieval system in S1 Library and Information Skills course.

6.4.3
Two features of the information retrieval system, the truncation of keywords in displayed entries and the use of upper case characters only, gave rise to some initial concern amongst teachers. Both restrictions, linked to the Apple computer rather than the program *per se*, were pointed out to pupils and were readily accepted. In practice, neither feature appeared to cause great problems for pupils who used

keyword checklists to identify any unrecognisable terms.

6.4.4
A new version of KWIRS was developed for the BBC-B microcomputer during the project. This move was initiated in response to requests from librarians and teachers throughout the country who had viewed the software during demonstrations of MISLIP. The opinion was often expressed that a menu driven system would be preferred with a microcomputer which was becoming more widely available in schools. Many who were interested in this approach to information skills considered that KWIRS compared favourably with other software available. Examples from Apple and BBC-B versions of KWIRS are shown in Appendix 3. (Phase 2 schools will be using BBC KWIRS.)

Database creation

A questionnaire approach to the design of databases helped focus attention on important factors at the planning stage.

6.4.5
During the development of databases, several factors emerged as important in the design and creation of each file. These points, covering the development of the keyword indexing and retrieval language and the content and layout of entries, were put together in a ten-point questionnaire (see Appendix 6). The aim was to provide a useful focus for discussion between librarians and teachers in the initial planning stages. This questionnaire was found to be useful by the librarian at Bankhead (see 6.3.8).

A good keyword indexing language was important to the success of a database.

6.4.6
The most important aspect in terms of the retrieval of relevant information was the development of the keyword indexing language. Initially, teachers considered that topic keywords and format of materials would be useful retrieval features in addition to the author search option, a standard feature of Apple KWIRS. In practice, no pupils were observed to use format or author. Information needs were usually expressed in terms of the topic itself and in later databases, only keyword and author search options were catered for.

Teachers and pupils were the most valuable sources of keywords.

6.4.7
Teacher involvement in the development of the keyword indexing language was crucial to the success of the information retrieval

system. Teachers provided broad outlines of a topic or course, information on pupils' background and introduction to the topic or task, the main concepts and detailed examples pupils were expected to explore and the aims of the course or assignment. In the case of MACOS, where classroom observation was possible throughout the first year, teachers were simply asked to comment on and add to outlines prepared by the researcher. For S2 topics and new parts of the curriculum, classroom observation was not possible. In such cases, teachers provided much of the necessary information in brief planning sessions and were consulted during the construction of each database. For librarians such an approach would appear to be fruitful not only in the development of a useful indexing language but also in terms of valuable insights into the curriculum (see 6.3.11).

6.4.8
Pupils themselves were important in the development of the indexing language. Classroom observation and pupils' written work provided useful information on the kind of language used by pupils themselves in describing topics and helped to indicate the kinds of questions posed in information enquiries. It was interesting that the new librarian at Bankhead regarded this as one of the most important factors in creating her first KWIRS database.

Evaluation of the success of the keyword indexing terms was important during the first uses of a database.

6.4.9
When direct observation or pupils' written work was not available, as might be the case for many librarians, it was necessary to be prepared to monitor the use of the database carefully so that any important gaps, in information or terminology, could be identified. Despite careful and detailed analysis by teacher and researcher when planning for new parts of the curriculum, some (minor) modification of the indexing terminology was usually felt to be appropriate when the first uses of the database were assessed. One example was the update of the database for the S2 humanities project where three new keywords were added to the database after the pilot exercise.

The ease with which keywords could be identified varied between different subjects.

6.4.10
It was generally easier to identify appropriate keywords for the science database than, for example, for the humanities database. This was due to a combination of factors. In the science topic, the concepts and examples were more clearly defined, more "concrete" and based on recognisable physical properties and laws. In the humanities topics, although concepts could be identified, there was greater scope for individual approaches to the information.

6.4.11
Some of the difficulty in very open topics could be alleviated by using relatively broad keywords but this had to be balanced against the objective of providing as direct and as specific access to information as possible. It was felt to be more useful to maintain a relatively specific terminology, being prepared to make some amendments if necessary after the first use of the database. This proved an acceptable strategy for teachers who were prepared to guide pupils towards alternative terminology if real problems should arise. In practice, the changes needed were usually small and did not affect the number or content of references in the database.

6.4.12
On two occasions pupils added information to a database. The new entries consisted of specific information which had previously been included only in more general references but which were considered by pupils to be important. S2 pupils were encouraged to add such information, including appropriate keywords, to the files. This gave them a sense of achievement and satisfaction, having made an important contribution to a database which others would be using, and was considered by teachers to be a valuable exercise in itself.

Consistency was important in the use of plural or singular terms although flexibility was provided for users by including as many important synonyms as possible.

6.4.13
Aspects such as the use of plurals or choice of synonyms were factors to be considered in the planning stages of database construction. With the automatic truncation of keywords to five characters and the use of sub-string searching in the Apple, the choice of plural or singular terms was less critical than with BBC KWIRS or some other programs where complete accuracy is needed in entering search terms. Consistency was felt to be important and plural terms were generally used in all databases.

6.4.14
Where two synonymous terms were used more or less equally by different teachers or pupils, or where "paired terms" arose (e.g. "structure and function") efforts were made to include both in a database. This depended on the number of keywords, depth of indexing and number of entries in each file. This will become more practical with the use of systems such as BBC KWIRS where a greater number of keywords may be applied to each entry. As a compromise, it was possible to create duplicate entries within Apple KWIRS files in order to cater for all keywords although, in practice, this was seldom necessary.

6.4.15
Pupils coped relatively easily with choices of synonyms or the use of singular or plural terms by referring to the keyword list after their planning sessions or when a search had proved fruitless. They were encouraged to work from their own terminology initially but a checklist of terms was necessary at the retrieval stage.

Alphabetical lists were considered the most useful way of displaying keywords for S1/S2 pupils although some analysis of relationships between concepts was useful as an indexing aid.

6.4.16
Display of keywords as checklists for pupils was restricted to simple alphabetical listings with references, where necessary, to synonyms or alternative terms. Teachers felt that a more structured representation (e.g. a map or thesaurus) would be too restrictive in the context of the very open and free approach to S1 and S2 assignments at Bankhead. Pupils were, instead, encouraged to explore the relationships within the topic, basing their enquiries on their own knowledge and questions, and adding new or alternative terms from the checklist.

6.4.17
The approach taken in this case was appropriate to a situation where the information retrieval system was used in the development of "classification" skills. It is possible, however, that there would be situations within different teaching and learning environments where a more structured display of concepts would be helpful for pupils in developing their information searches (see 6.1.23). This is a factor which it may be possible to investigate in Phase 2 of MISLIP, involving a number of schools using databases within different kinds of assignments.

6.4.18
Some analysis of the relationships between concepts was useful as an aid to indexing and, in the long term, to updating of databases. For smaller topics, a mapping approach was useful in looking at the overall structure of the topic in order to identify relevant information, an approach used with pupils in their own information enquiries.

6.4.19
Where the database coverage was wider, catering for more general and more flexible use (i.e. not linked to a particular assignment), a more traditional thesaurus (see Appendix 6) was constructed as an indexing tool. This was more time consuming but useful for future reference in a situation where a map would have proved too complex for rapid appraisal.

It was important to consider the needs and the abilities of each group of users when planning the content and layout of databases.

6.4.20
Another factor to be considered at the design stage was the content of each entry i.e. the kind of information needed, the amount of information needed and the layout of each entry. Teachers were consulted in each case and decisions were based on knowledge of pupils' information skills background and on the aims and objectives of each assignment or course.

6.4.21
In most cases, bibliographic details were kept to a minimum, supplying only the information needed to recognise an item on the shelf and a location code (either the Dewey number or A/V code or departmental location code.) The only publication detail which was thought by librarian and teachers to be useful was the date of publication which could be used, if necessary, to evaluate and compare information.

6.4.22
Teachers were also involved in decisions about the depth of indexing, the inclusion of page references and the use of brief notes about the content of each item. Page references were popular with most teachers although there was an acknowledgement that from S2 onwards, pupils should be encouraged to use indexes in books. This factor had to be balanced by the fact that, in topics such as "streamlining" in science, information tended to be scattered within more general texts and very often not specifically indexed in books. In discussions, the reaction of pupils to the inclusion of page references, comments and notes in database entries was mixed, with S2 pupils becoming more critically aware of advantages and disadvantages in each approach (see 6.1.44). Pupils were observed to use notes and page references in selecting resources and information within resources.

6.4.23
In considering the layout of information within each entry, readability was felt to be more important than economy of space. The importance of this was highlighted by observations of difficulties faced by some pupils in following up references on print-outs, a difficulty linked by teachers to a general need to help pupils develop flexible reading strategies. In non-fiction databases in particular, it was important to separate each element of the entry as much as possible, leaving blank lines between bibliographic details and notes or page references. In the absence of colour, it was possible to use such features as brackets to isolate particular elements such as location codes.

6.4.24
In the design of all databases, it was necessary to take into account limitations of hardware and software but all decisions were based on

the needs of pupils (i.e. the users of the system). It was possible with existing technology to provide an information retrieval system which pupils found attractive and easy to use.

Close liaison between teachers and librarian was seen as essential to the successful creation of curriculum-based databases.

6.4.25
While the construction of each database was seen by teachers as the librarian's task (although many of the Bankhead computer files were constructed by the researcher), the design of each database was a matter for close consultation with teachers. Overall, the close cooperation between teachers and librarian was seen as one of the most important aspects of the whole process of database creation.

Summary

6.4.26
The following points were considered to be important in the design and creation of curriculum-based databases:

* Librarians and teachers considered it important to use information retrieval software which was simple and as self-explanatory as possible;

* Careful planning of databases in terms of content, layout and indexing terminology was essential to the successful use of the information retrieval system;

* The quality of the keyword indexing language was important to the success of a database - identification of key concepts, decisions on the use of synonyms and singular or plural terminology were important at the palnning stages;

* Teachers and pupils were the most valuable sources of keywords for curriculum topics, although successful identification of keywords varied between topics and tasks;

* Evaluation of the keywords, design and content of entries was an important element during pilot use of a database by pupils;

* Alphabetical lists were considered the most useful way of displaying keywords for S1/S2 pupils although some analysis of relationships between concepts was useful as an indexing aid;

* It was important to base all design and development

decisions on the needs and abilities of users and the aims and objectives of the curriculum;

* Close liaison between teachers and librarian was seen as essential to the successful creation of curriculum-linked databases.

6.5 External reaction

MISLIP was of interest to teachers, librarians and educationalists in terms of information skills and information technology

6.5.1
The approach, progress and findings of MISLIP have been presented at various meetings around the country. It has been seen as relevant to, for example, developments in resource-based learning (Resource-based Learning in the Secondary School, St Andrew's College of Education, Glasgow 1984), current moves in the use of educational databases (Educational Databases in Scotland: SCET, 5 Oct 1984), inservice training of school librarians (Inservice meetings and workshops in Grampian and Lanark) and current developments in librarianship generally (e.g. SLG meetings - "The Microcomputer in the School Library", Dundee 15 February 1984; "Managing the School Library Service", Edinburgh July 1985).

6.5.2
Close links have also been maintained with other current research projects in the field of information skills in school. Membership of the British Library Discussion Group for Researchers in Educating Information Users in Schools has proved a useful forum for discussion with other researchers working at Primary and Secondary level in schools.

6.5.3
Feedback at such meetings, visits to school libraries and the considerable correspondence received from UK and abroad, often in response to publications (11), has indicated the interest and growing awareness of the need to help pupils develop information skills.

6.5.4
Librarians and teachers have been interested in both the information skills and information technology aspects of MISLIP. The keyword approach and the use of the microcomputer information retrieval system have been viewed as attractive and motivating methods of helping pupils develop information skills with a cross-curricular relevance.

6.5.5
There have been strong indications that many schools are ready to begin the development of information skills programmes and would welcome new ideas which could be incorporated into those developments. As a result of the interest shown in MISLIP, there was felt to be a place for a further development and dissemination phase.

6.5.6
During Phase 2 (September 1985 - August 1987) MISLIP will support and monitor six schools around Scotland as librarians and teachers develop

and adapt the ideas and findings of Phase 1 for a range of subjects and tasks within their own curricula. An information "pack" will also be distributed to all secondary schools in Scotland, incorporating findings, examples, case studies and guidelines on the development and use of a keyword approach to information skills.

7 CONCLUSIONS

The keyword approach and the development and use of curriculum-based databases can be worthwhile for pupils, teachers and librarian.

7.1
Benefits can be seen for pupils, teachers and librarians in the development of the keyword approach to information-handling. Pupils are encouraged to define clear purposes in relation to information needs. They are encouraged through the use of bibliographic databases to make more use of a wider range of resources than is the case when they use a traditional catalogue. The microcomputer is seen by teachers as a motivational influence in the initial stages of project work helping to make projects "more active".

7.2
In terms of information skills development, pupils benefit from using the information retrieval system in a number of different contexts over a period of time. They can develop confidence and ability to translate information needs into useful search strategies. They can also develop an awareness of the concept of the computer as an information handling tool through application when there is a real need to find information.

The development and use of databases can create closer links between the library and the curriculum.

7.3
The interest stimulated amongst teachers and pupils encourages closer links between the curriculum and the library generally. Through working closely with teachers and pupils the librarian gains a deeper insight into the information needs of the curriculum. In the development of databases close cooperation between librarian and teacher becomes essential to the success of the database and the need for careful planning can lead to rewards for teachers and librarians.

The microcomputer information retrieval system can be a useful focus for the development of information skills across the curriculum

7.4
The development of skills within and across the curriculum is seen as important by teachers and librarians but presents many practical problems. The use of databases is seen as interesting and relevant in different subject areas and this can help create a cross-curricular basis for developing information retrieval skills. A keyword approach to the whole assignment can focus attention on information handling before and after the computer. Some of the practical issues relating to the integration of information skills within the curriculum can

then be investigated through focussing developments in such areas as the use of keywords and classification in reading, notemaking and organising information in curricular tasks.

The use of a database should be seen as an integral part of the whole assignment.

7.5
The need for pupils to have a clear purpose in order to locate, select and organise information is clearly seen in observations made of S1/S2 project work. While the information retrieval system encourages pupils to state their aims more clearly as search strategies, longer term benefit is derived when the use of a database is seen as only part of the complete process of finding and using information. When pupils are encouraged to plan their assignments, stating clearly their purposes, asking questions and using their questions as the basis of the development of search strategies, they maintain a clearer sense of purpose in the later stages of the assignment. The use of the database helps maintain this sense of purpose through the information retrieval stages.

7.6
The use of planning sheets also encourages pupils to record their own decisions at the beginning of a project and at regular intervals during their work. Through discussion, this structured planning approach can form a useful basis for evaluating not only the information they are finding but also the processes they are going through.

7.7
The use of databases focusses on the need to develop "classification" skills in relation to developing keyword search strategies. The information retrieval system can itself help pupils develop a sense of "general and specific" but exploring the use of "classification" and keywords in reading, notemaking, and summarising within curricular tasks can be profitable in developing an awareness of the links between finding and using information.

A partnership between library and teaching staff leading to a clear statement of aims is an essential starting point in the development of a curriculum-related information retrieval system.

7.8
For teachers and librarians seeking to develop the microcomputer information retrieval system as an educational tool there are important implications for the development and management of databases and information-handling assignments as a whole. To form an effective link between the information and the curriculum, a database needs to

be carefully planned in relation to the needs of users and the aims and objectives of the curriculum. It is essential, therefore, that knowledge of the curriculum, users (i.e. pupils), and resources is taken as a starting point and that librarians and teachers work together within a joint statement of aims.

7.9
The development of a curriculum-related retrieval language is important so that pupils can be as free as possible to use their own knowledge of the subject to develop and test suitable search strategies. It is the freedom and flexibility in this form of information retrieval which will help them form the connection between purpose and information. It will rarely be possible in open-ended project work to cater for all the terms pupils will want to use but it is possible, through careful planning, discussion and appraisal of work materials, such as worksheets and previous examples of written work, to provide a system which pupils can relate to more directly than the traditional catalogue.

7.10
Time must also be spent designing content and layout of individual records in a file. The type of information to be provided (whether bibliographic and/or factual), the age range of materials to be included, the amount of information needed for pupils to identify and use a resource, (location symbols, page references, notes, etc) are among the important factors to be considered in terms of the content of a database. The layout influences how easily information can be read and used, on screen or on print-out, and experimenting with layouts in "trial" databases should be considered as a useful element at the planning stage. At the risk of "wasting space" it may be important, for example, to space out individual elements of an entry to make it more readable for pupils.

7.11
The design of a database is potentially more time-consuming than many of the subsequent stages of database creation. It is important to work from a clear statement of aims in terms of users, skills and curriculum content. For librarians, many of the steps involved in selecting materials and information and in designing and indexing records will not be new. The development of a detailed keyword language, related to specific areas of the curriculum, is an aspect which may be new and which will pose the greatest challenge. Experience has shown that this is likely to be the most time-consuming stage of developing a curriculum-related database but also one of the most rewarding for teachers and librarians in terms of relating resources to the curriculum.

7.12
Certain implications also emerge for the planning of assignments in terms of content and skills. Pupils need to be provided with the

framework of knowledge which will help them select a manageable topic and define clear purposes. If they have a very limited knowledge of the topic it is difficult for pupils to define specific purposes by means of questions and keywords. The practical issue of over-demand on particular resources can be a reflection of too narrow a base of knowledge upon which to base an enquiry. The classroom introduction is, therefore, a very important influence on pupils performance in project work.

7.13
S1/S2 pupils need guidance throughout project work not only in terms of the information they are gathering and organising but also in terms of the processes involved. Pupils do not transfer skills automaticaly from one area of the curriculum to another but can be helped by reminders and reinforcement of skills. At the very least, this implies that there is a need for some knowledge amongst subject teachers of the content and timetable of any Library and Information skills programmes within school. It also suggests the need for knowledge of the sort of opportunities pupils are being presented with across the curriculum to use those skills. In the development of information retrieval skills, for example, pupils benefit from being given the opportunity to use databases in a number of different contexts over a period of time. It is helpful to be able to remind pupils of such experiences when introducing a new assignment.

7.14
The practical issues surrounding the use of a microcomputer with large groups of pupils should also be considered in planning an assignment. Ideally pupils should feel free to return to the computer when there is a need to change direction or alter a search strategy having evaluated resources and information. Such freedom, as part of an individualised approach to development of knowledge and skills, is not always a practical possibility when large numbers of pupils are involved in the same assignment. Some consideration must, therefore, be given to methods of avoiding queueing at the computer.

7.15
The provision of a printer can be an important factor in encouraging pupils to move away from the computer before discussing the outcome of a search with their classmates or teacher. Allowing pupils to proceed at their own pace in the planning stages of a project, discussing and recording decisions and developing search strategies on paper before the computer, can also help to spread the demand made on the computer at any one time as well as being a beneficial process in the development of clear purposes.

7.16
In both creating and using databases careful planning should be seen as essential. For the designers of curriculum assignments (i.e. teachers and librarians) the planning stage clarifies content, scope

and layout of database entries in relation to the aims of the exercise. For learners (i.e. pupils) planning is important in clarifying purpose and information needs. Without these stages the potential of the microcomputer information retrieval system as a learning tool willnot be fully exploited.

Further developments

7.17
From September 1985 to August 1987 six schools will be involved in Phase 2 of the project. Librarians and teachers will work together to develop curriculum-related bibliographic databases. MISLIP will monitor the development and implementation of ideas and findings from Phase 1 in a range of different subjects, age groups and learning environments.

7.18
As well as organising workshops for school librarians and teachers not directly involved in MISLIP, a practical information skills pack will be distributed to each secondary school in Scotland. This will present the findings and practical examples of the keyword approach in terms of exercises, comments from pupils, teachers and librarians, case studies and guidelines.

8 RECOMMENDATIONS

The following recommendations are made in the light of conclusions drawn from the findings discussed above. Recommendations are addressed to those who have a role to play in the development of information skills and the use of information technology in school libraries.

8.1 Head teachers

Head teachers should

support and encourage information skills development across the curriculum

encourage and support the use of the microcomputer as an information retrieval tool in the school library

encourage and support teachers and librarians in the development and use of curriculum-related databases as part of information skills programmes.

8.2 Teachers

Teachers should

view the development of information skills as a long-term, cross-curricular aim

integrate the use of the library and the microcomputer information retrieval system within the curriculum, in terms of content and skills

introduce pupils to the use of the microcomputer information retrieval system over a period of time and in a number of different contexts

cooperate with school librarians in all development of information skills including the use of curriculum-related databases.

8.3 School librarians

School librarians should

see the use of the microcomputer as an essential skill in personal and library development

consider the use of the microcomputer in the library as a motivating and useful means of accessing information for pupils

consider the use of the microcomputer as part of user education/information skills programmes

undertake the development of curriculum-related databases only with the support and cooperation of teachers

8.4 Teachers and librarians

Teachers and school librarians should

collaborate closely in the design, development and implementation of all curriculum-related databases

produce a clear statement of aims in terms of content and skills, based on the needs and abilities of pupils, as a preliminary stage in the development and use of a microcomputer information retrieval system.

8.5 School Library Services

School Library Services should

provide inservice training and support in the use of the microcomputer as an information retrieval tool in the school library

provide assistance and support to school librarians in terms of hardware, software and resources, where necessary

provide information and advice on the development and use of the microcomputer in the school library

8.6 Local Education Authorities

LEAs should

develop a clear policy on the development of information skills and information technology in schools

support and encourage information skills development across the curriculum

encourage and support the use of the microcomputer as an information retrieval tool in the school library

support the provision of microcomputer hardware and software for use in school libraries.

8.7 Colleges of Education

Colleges of Education should

encourage awareness of research projects such as MISLIP and SIR (8)

incorporate information skills development and the use of information technology within the curriculum of teachers in training

develop teachers' awareness of the importance of information skills, information technology and the role of libraries in schools.

8.8 Schools of Librarianship and Information Studies

SLISs should

develop an awareness amongst new librarians of the use of the microcomputer as an information retrieval system

develop an awareness amongst new librarians of the educational role of the library and librarian in the school curriculum

SLISs should....

encourage further research in the area of information skills/information technology in schools.

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Brief information and progress reports:

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INFUSE 9 (5) Oct 1985. 8-9.

SLA News No.179 Jan-Feb 1984. 11.

VINE 50 Oct 1983. 47-48.

APPENDIX 1 : GLOSSARY

Database : A collection of information (factual or bibliographic) stored in one or more computer files, organised in such a way as to allow access to specific information.

File : A collection of information stored in a number of records or entries on a floppy disk - the main structural unit of a database. For example, an "Animals" file would contain a number of bibliographic references to books and other materials on animals.

Keyword mapping : A simple form of concept mapping (see below) in which the relationships between concepts are displayed in a schematic way. Keyword maps were used as a summarising and planning tool for pupils in MISLIP. Examples can be seen in Appendix 3.

Further definition of concept mapping and examples of its application as a learning tool can be found in, for example:
Novak, J D & Gowin, D H : Learning how to learn. Cambridge University Press, 1984.

Jonassen, D H : Developing a learning strategy using pattern notes: a new technology. PLET 21 (3) August 1984. 163-175.

APPENDIX 2 : LIBRARY SKILLS COURSE. BANKHEAD ACADEMY 1985. (Extract)

The Library Skills Course is designed to be cross-curricular and this section prepares pupils to find information from sources relevant to all subject areas - encyclopedias, project boxes, atlases etc. The booklet also aims to encourage pupils to

* think about selecting keywords when searching for information

* to become familiar with the index and various volumes of Children's Britannica

* to read for information

* to use a Bell-Howell and slide tapes as an additional resource

* to use an atlas as an information source

The reaction of many teachers to pupils' projects is that they are "disappointing". The Take Note booklet looks at problems encountered by pupils when researching for a project and is intended to guide them towards tackling project work more positively and towards achieving more successful outcomes.

Take Note

* looks at different kinds of reading, the importance of reading for instructions, skimming, scanning etc.

* the components of successful note taking are considered in detail e.g. abbreviations, lay-out, headings, use of colour etc.

* mentions scanning books for suitability

* considers skim-reading and search-reading, and the all-important selection and rejection of information.

* stresses the organisation and layout of notes and suggests diagrammatic methods of organisation - spider, family tree, "taking a line for a walk"

* includes a mini research task stressing the importance of a different outcome and showing how effective diagrammatic presentation of information can be (it is thought useful that these outcomes should be displayed in the library)

APPENDIX 3 : EXAMPLES OF RECORDS FROM BIBLIOGRAPHIC DATABASES

S1 MACOS database (Apple version of KWIRS)

```
------------------------------------------------------
6
FOGDEN M & P; ANIMALS AND THEIR COLOURS; 1974.     (599)
PAGES 31-75 - CAMOUFLAGE AND DISGUISE.

KEYWORDS.........ADAPT ENVIR COLOU
                 CAMOU DISGU
FORMAT...........BOOK
------------------------------------------------------
```

S2 Humanities database

a) Apple version of KWIRS

```
------------------------------------------------------
40
THE DREAM OF MARTIN LUTHER KING.    SLIDE SET 36A
SLIDE 9 - A PLAN OF A SLAVE SHIP.

KEYWORDS.........SLAVE TRADE SHIPS

FORMAT...........SS
------------------------------------------------------
```

b) BBC-B version of KWIRS

```
------------------------------------------------------
44.
HOBDEN S M; Mother Teresa; 1973.       (Book  B.Ter)
Pages 18-24 - Mother Teresa's work in India.

KEYWORDS............INDIVIDUALS
                    INDIA
                    POVERTY
                    LEPERS
                    CHILDREN
                    TERESA
AUTHOR..............HOBDEN
------------------------------------------------------
```

APPENDIX 4 : SEARCH STRATEGIES

The following are two examples of search strategies used by pupils in (a) S2 humanities and (b) S2 science projects. Each shows the progression from title to specific searches based on purposes initially defined as questions.

(a) Susan

Project title: Life of Mother Teresa

Questions:

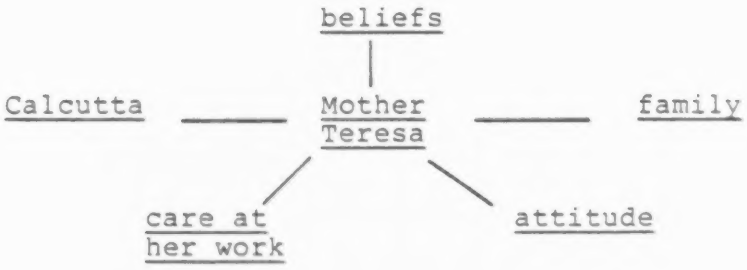
1) Was she brought up to care for younger children e.g. brothers and sisters?

2) Did her parents agree to her becoming a nun?

3) What sort of place is Calcutta?

4) What sort of work did she do in Calcutta?

Keywords : (mapped out on planning sheet)



Search strategy: (after checking keyword list)

1 Teresa AND UNICEF -> 0 references
(Susan decided she could try Teresa AND Children instead but did not complete this search)

2 Teresa AND Lepers -> 6 references

3 Teresa AND childhood -> 4 refs.

4 Teresa AND religions -> 6 refs.

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Lepers and UNICEF were related to Susan's interest in Mother Teresa's work in Calcutta, religions was used to replace "beliefs" and childhood represented part of Susan's interest in Mother Teresa's family life (she could also have chosen parents).

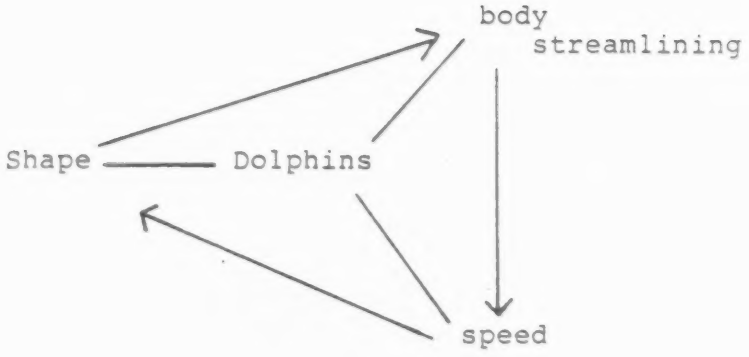
(b) Jane

Jane began by being interested when the teacher suggested that streamlining is useful for animals that move in water. She was interested in penguins and dolphins and finally chose Streamlining of a dolphin as her project title. Her knowledge of a dolphin at this stage was not related to streamlining. She knew that "Dolphins live in water and are very intelligent". She also knew that dolphins were mammals.

Questions:
(Jane highlighted keywords in each question)

1) How does body help the streamlining?
2) Why is it so important to them?
3) Does the streamlining affect the dolphins speed?
4) Does the streamlining affect the dolphins shape?

Keyword "map":
(produced on planning sheets)



Search strategy:
(after checking
keyword list)

1 Mammals AND Speed AND Dolphins
-> 0 references (Dolphin was not a keyword in the database at this stage)

2 Mammals AND Speed AND Sea
-> 4 references

3 Mammals AND Sea AND Shape
-> 5 references

APPENDIX 5 : KEYWORD LIST

Extract from a list used with the "Survival file"

ANIMALS
BERRIES
BIRDS
CLIMATE
CLOTHES
COAST
DYES
FIRE
FISH
FLOWERS
FOOD
FRUIT
FUEL
FUNGI
HERBS
INJURIES
INSECTS
ISLANDS
LANDSCAPE
LEAVES
MEDICINES
MOORS
MOUNTAINS
NUTS
PLANTS
POISONS

APPENDIX 6 : MACOS THESAURUS (Extract)

Colour UF Animal colouration
BT Adaptation Camouflage Signals
RT Mimicry Patterns Counter-shading

Communication BT Information
NT Gestures Signals Language
RT Behaviour Societies

Conflict BT Behaviour
NT Aggression
RT Threat

Counter-shading BT Camouflage Adaptation
RT Mimicry Deception Patterns Colour

APPENDIX 7 : DATABASE DEVELOPMENT QUESTIONNAIRE (Extract)

Section 1 : keyword collection

1) What is the general topic/subject area you want to cover?

Can you suggest a simple name for this file?

2) Which related topics or ideas have been covered in class as an introduction or background to the topic?

3) List any words or phrases which have been stressed or defined as part of the background to the topic.

4) Can you suggest any other keywords which you might expect pupils to think of in their first searches for information?

5) Which new ideas/concepts do you expect some or all pupils to cover in their assignment? (Please include any specific examples you would expect pupils to use)

6) Do you expect pupils to cover all or most of the above or do you expect them to cover one or two items in depth?